LAMPIRAN

Lampiran 1. Penyederhanaan Persamaan (3.17)

$$m'(y_n) = f[y_n, z_n] - \frac{f(z_n) f[x_n, y_n, z_n]}{f[z_n, x_n]} + f(y_n) \frac{f[x_n, y_n, z_n]}{f[x_n, z_n]}. \tag{L.1}$$

Persamaan (L.1) disederhanakan sehingga didapat

$$m'(y_n) = \frac{f[y_n, z_n] f[x_n, z_n] + f[x_n, y_n, z_n](f(y_n) - f(z_n))}{f[x_n, z_n]}. \tag{L.2}$$

Dari persamaan (L.2), fungsi $f[x_n, y_n, z_n]$ disederhanakan sehingga ditulis

$$f[x_n, y_n, z_n] = \frac{f[x_n, y_n] - f[y_n, z_n]}{x_n - z_n} = \frac{\frac{f(x_n) - f(y_n)}{x_n - y_n} - \frac{f(y_n) - f(z_n)}{y_n - z_n}}{x_n - z_n},$$

$$= \frac{(f(x_n) - f(y_n))(y_n - z_n) - (f(y_n) - f(z_n))(x_n - y_n)}{(x_n - y_n)(x_n - z_n)(y_n - z_n)},$$

$$= \frac{f(x_n)(y_n) - f(x_n)(z_n) - f(y_n)(y_n) + f(y_n)(z_n) - f(y_n)(x_n)}{(x_n - y_n)(x_n - z_n)(y_n - z_n)}$$

$$+ \frac{f(y_n)(y_n) + f(z_n)(x_n) - f(z_n)(y_n) + (f(x_n)(x_n) - f(x_n)(x_n))}{(x_n - y_n)(x_n - z_n)(y_n - z_n)},$$

$$= \frac{\dfrac{(f(x_n)(x_n) - f(x_n)(z_n) - f(y_n)(x_n) + f(y_n)(z_n))}{(x_n - y_n)(x_n - z_n)}}{(y_n - z_n)}$$

$$- \frac{\dfrac{\big(f(x_n)(x_n) - f(x_n)(y_n) - f(x_n)(y_n) + f(x_n)(y_n)\big)}{(x_n - y_n)(x_n - z_n)}}{(y_n - z_n)},$$

$$= \frac{\dfrac{(f(x_n) - f(y_n))(x_n - z_n)}{(x_n - y_n)(x_n - z_n)} - \dfrac{(f(y_n) - f(z_n))(x_n - y_n)}{(x_n - y_n)(x_n - z_n)}}{(y_n - z_n)},$$

$$= \frac{\dfrac{(f(x_n) - f(y_n))}{(x_n - y_n)} - \dfrac{f(y_n) - f(z_n)}{(x_n - z_n)}}{(y_n - z_n)},$$

$$= \frac{f[x_n, y_n] - f[x_n, z_n]}{y_n - z_n}.$$

(L.3)

Hasil penyederhanaan yang terdapat pada persamaan (L.3) disubstitusikan ke persamaan (L.2) lalu disederhanakan lagi sehingga dapat ditulis

$$m'(y_n) = \frac{f[y_n, z_n]f[x_n, z_n] + \left(\frac{f[x_n, y_n] - f[x_n, z_n]}{y_n - z_n}\right)(f(y_n) - f(z_n))}{f[x_n, z_n]},$$

$$= \frac{f[y_n, z_n]f[x_n, z_n] + (f[x_n, y_n] - f[x_n, z_n])\left(\frac{f(y_n) - f(z_n)}{y_n - z_n}\right)}{f[x_n, z_n]},$$

$$= \frac{f[y_n, z_n]f[x_n, z_n] + (f[x_n, y_n] - f[x_n, z_n])\left(\frac{f(y_n) - f(z_n)}{y_n - z_n}\right)}{f[x_n, z_n]},$$

$$= \frac{f[y_n, z_n]f[x_n, z_n] + (f[x_n, y_n] - f[x_n, z_n])(f[y_n, z_n])}{f[x_n, z_n]},$$

$$= \frac{f[y_n, z_n]f[x_n, z_n] + f[x_n, y_n]f[y_n, z_n] - f[y_n, z_n]f[x_n, z_n]}{f[x_n, z_n]},$$

$$= \frac{f[x_n, y_n]f[y_n, z_n]}{f[x_n, z_n]} \qquad \text{(L.4)}$$

Lampiran 2. Hasil Perhitungan Beda Terbagi Persamaan (3.20)

$$
\begin{aligned}
f[x_n, z_n] &= \frac{f(x_n) - f(z_n)}{x_n - z_n} \\
&= c_1 + (c_2c_1 + 2c_2)e_n + \left(\frac{c_3}{c_1} + c_3{c_1}^2 + 3c_3c_1 + {c_2}^2 + 2c_3\right){e_n}^2 \\
&\quad + \left(\frac{-c_3c_2 + 2c_1c_2c_3 + c_1c_3 + 6c_4{c_1}^2 + 4c_1c_4 + 4{c_1}^3c_4}{c_1} + \frac{-c_3 + c_4{c_1}^4 + 2{c_1}^2c_2c_3}{c_1} - \frac{c_2c_3}{{c_1}^2}\right){e_n}^3 \\
&\quad + (\frac{c_2c_3 - c_1c_2c_3 - 4c_2c_4{c_1}^3 - c_2c_4{c_1}^4 - 2{c_2}^2c_3{c_1}^2 + c_3{c_2}^2}{{c_1}^2} \\
&\quad + \frac{-2c_1{c_3}^2 - 3{c_1}^2{c_3}^2 - {c_3}^2 - 6c_1c_2c_4 - 3c_1{c_2}^2c_3 - {c_1}^3{c_3}^2 - 7{c_1}^2c_2c_4}{{c_1}^2} + \frac{{c_2}^2c_3}{{c_1}^3})e_n{}^4 + O({e_n}^5).
\end{aligned}
\tag{L.5}
$$

$$
\begin{aligned}
f[x_n, y_n] &= \frac{f(x_n) - f(y_n)}{x_n - y_n} \\
&= c_1 + c_2e_n + \frac{({c_1}^2{c_2}^2 + {c_1}^3{c_2}^2)}{{c_1}^3}{e_n}^2
\end{aligned}
$$

$$+\frac{c_2{c_1}^3c_3+2c_3c_1c_2+3c_2c_3{c_1}^2-2c_1{c_2}^3+c_4{c_1}^2}{{c_1}^2}+\frac{-2{c_2}^3+{c_1}^2c_3-{c_1}^2{c_2}^3}{{c_1}^2}{e_n}^3$$

$$+(-3{c_2}^4{c_1}^3-{c_2}^4{c_1}^4+4c_2c_4{c_1}^3+c_2c_3{c_1}^3-3{c_1}^2{c_2}^4-3{c_1}^3c_3{c_2}^2+c_3{c_1}^4{c_2}^2$$

$$+7c_2c_4{c_1}^4+4c_2c_4{c_1}^5+{c_1}^6c_2c_4+c_2{c_1}^4c_3){e_n}^4+O({e_n}^5). \quad \text{(L.6)}$$

$$f[y_n,z_n]=\frac{f(y_n)-f(z_n)}{y_n-z_n}$$

$$=c_1+c_2(1+c_1)e_n+\frac{c_1c_3+{c_2}^2+2{c_1}^2c_3+3c_1{c_2}^2+3c_3{c_1}^3+2{c_2}^2{c_1}^2+{c_1}^4c_3}{c_1(1+c_1)}{e_n}^2$$

$$+(\frac{c_4{c_1}^2+11{c_1}^2c_2c_3+3c_1c_2c_3-2{c_2}^3-6{c_2}^3c_1+5c_4{c_1}^3+{c_1}^3c_3}{{c_1}^2(1+c_1)^2}$$

$$+\frac{10c_4{c_1}^4+{c_1}^4c_3-7{c_1}^2{c_2}^3+10c_4{c_1}^5-4{c_1}^3{c_2}^3+5{c_1}^6c_4-{c_2}^3{c_1}^4}{{c_1}^2(1+c_1)^2}$$

$$+\frac{{c_1}^7c_4+14{c_1}^4c_2c_3+19{c_1}^3c_2c_3+4{c_1}^5c_2c_3}{{c_1}^2(1+c_1)^2})e_n{}^3.$$

$$+(\frac{-39{c_1}^4{c_2}^2c_3-49{c_1}^3{c_2}^2c_3+{c_1}^7c_2c_4+41c_2c_4{c_1}^4-17{c_1}^5{c_2}^2c_3}{{c_1}^2(1+c_1)^3}$$

$$+\frac{-3{c_1}^6{c_2}^2c_3+8c_2c_4{c_1}^6+25{c_1}^5c_2c_4+4{c_1}^4{c_1}^4+7{c_1}^3{c_2}^4+6{c_1}^6{c_3}^2}{{c_1}^2(1+c_1)^3}$$

$$+\frac{15{c_1}^5{c_3}^2+21{c_1}^4{c_3}^2+{c_1}^5{c_2}^4+{c_1}^7{c_3}^2+{c_2}^4+4{c_2}^4c_1+17{c_1}^3{c_3}^2}{{c_1}^2(1+c_1)^3}$$

$$+\frac{8{c_1}^2{c_3}^2+2{c_3}^2c_1+7{c_1}^2{c_2}^4+{c_1}^3c_2c_3+{c_1}^2c_2c_3-18{c_2}^2c_1c_3}{{c_1}^2(1+c_1)^3}$$

$$+\frac{-4{c_2}^2c_3+4c_1c_2c_4-37c_3{c_1}^2{c_2}^2+38{c_1}^3c_2c_4+19c_2c_4{c_1}^2}{{c_1}^2(1+c_1)^3})e_n{}^4+O(e_n{}^5). \quad \text{(L.7)}$$

Lampiran 3. Hasil Perhitungan Parameter a_0, a_1, b_1, dan Jumlah dari $a_1 - a_0 b_1$ Terhadap Persamaan (3.51)

$$b_1 = \frac{-(c_1{}^4 c_2 + c_2 c_1 + 3c_1{}^2 c_2 + 3c_2 c_1{}^3)}{(1+c_1)^3} - (\frac{(5c_3 c_1{}^6 + c_1{}^7 c_3 + 4c_3 c_1{}^3) + c_3 c_1{}^2 + 7c_2{}^2 c_1{}^3 + 5c_2{}^2 c_1{}^5)}{(1+c_1)^3 c_1{}^2}$$

$$+ \frac{9c_2{}^2 c_1{}^4 + 8c_1{}^4 c_3 + 9c_1{}^5 c_3 + 2c_2{}^2 c_1{}^2 + c_1{}^6 c_2{}^2)}{(1+c_1)^3 c_1{}^2})e_n - (\frac{27c_1{}^4 c_2 c_3 + 19c_1{}^6 c_4 + 43c_3 c_1{}^5 c_2 + 35c_3 c_1{}^6 c_2}{(1+c_1)^3 c_1{}^3}$$

$$+ \frac{14c_1{}^7 c_2 c_3 - c_3 c_1{}^3 + 3c_4 c_1{}^4 + 3c_2{}^3 c_1{}^5 + 2c_1{}^8 c_3 c_2 + 15c_4 c_1{}^7 + 6c_4 c_1{}^8 + c_2{}^3 c_1{}^3 - c_1{}^5 c_3 - 2c_1{}^4 c_3}{(1+c_1)^3 c_1{}^3}$$

$$+ \frac{12c_4 c_1{}^5 + c_3 c_1{}^2 c_2 + 8c_3 c_1{}^3 c_2 + c_2{}^3 c_1{}^6 + c_1{}^9 c_4}{(1+c_1)^3 c_1{}^3})e_n{}^2 - (\frac{-3c_1{}^4 c_2 c_3 - 2c_3 c_1{}^5 c_2 + 75c_1{}^6 c_2 c_4}{(1+c_1)^3 c_1{}^4}$$

$$+ \frac{79c_1{}^7 c_2 c_4 + 22c_1{}^5 c_3 c_2{}^2 - 2c_1{}^4 c_2 h_4 - 6c_1{}^5 c_2 h_4 + c_1{}^4 c_3 c_2{}^2 + 32c_2{}^2 c_3 c_1{}^6 + 19c_2{}^2 c_1{}^7 c_3 + 47c_2 c_4 c_1{}^8}{(1+c_1)^3 c_1{}^4}$$

$$+ \frac{27c_1{}^8 c_3{}^2 + 49c_1{}^7 c_3{}^2 + 8c_1{}^9 c_3{}^2 - 6c_1{}^6 c_2 h_4 + 4c_1{}^8 c_2{}^2 c_3 + 15c_1{}^9 c_2 c_4 - c_3 c_1{}^3 c_2 + 38c_2 c_4 c_1{}^5}{(1+c_1)^3 c_1{}^4}$$

$$+ \frac{-c_3 c_1{}^2 c_2{}^2 + 8c_2 c_4 c_1{}^4 - 4c_3 c_1{}^3 c_2{}^2 + 12c_3{}^2 c_1{}^4 + 2c_3{}^2 c_1{}^3 - 2c_1{}^7 c_2 h_4 + 2c_1{}^{10} c_2 c_4 + c_1{}^{10} c_3{}^2}{(1+c_1)^3 c_1{}^4}$$

$$+\frac{+2{c_3}^2{c_1}^3-2{c_1}^7c_2h_4+2{c_1}^{10}c_2c_4+{c_1}^{10}{c_3}^2+51{c_1}^6{c_3}^2+32{c_1}^5{c_3}^2}{(1+c_1)^3{c_1}^4}{e_n}^3-\frac{2{c_1}^5c_3{c_2}^2+2{c_1}^4c_3{c_2}^2}{{c_1}^5(1+c_1)^3}$$

$$+\frac{2{c_2}^2c_3{c_1}^6+{c_2}^2{c_1}^7c_3+68c_4{c_1}^9{c_2}^2-16{c_2}^3c_3{c_1}^3+{c_2}^3c_3{c_1}^2-86{c_2}^3c_3{c_1}^4-174{c_2}^3c_3{c_1}^5}{{c_1}^5(1+c_1)^3}$$

$$+\frac{-198{c_2}^3c_3{c_1}^6-5{c_3}^2c_2{c_1}^4-3{c_3}^2c_2{c_1}^3+20{c_3}^2c_2{c_1}^5+85{c_3}^2c_2{c_1}^6+137{c_3}^2c_2{c_1}^7+24{c_1}^5c_3c_4}{{c_1}^5(1+c_1)^3}$$

$$+\frac{3c_4c_3{c_1}^4+8{c_2}^2c_4{c_1}^4+85c_4c_3{c_1}^6+49c_4{c_1}^5{c_2}^2+169c_4c_3{c_1}^7+125{c_2}^2c_4{c_1}^6+204c_4c_3{c_1}^8}{{c_1}^5(1+c_1)^3}$$

$$+\frac{173c_4{c_1}^7{c_2}^2-146c_3{c_1}^7{c_2}^3-72c_3{c_1}^8{c_2}^3+116c_2{c_1}^8{c_3}^2+53c_2{c_1}^9{c_3}^2+153c_4c_3{c_1}^9}{{c_1}^5(1+c_1)^3}$$

$$+\frac{141c_4{c_1}^8{c_2}^2+70c_4c_3{c_1}^{10}+8{c_2}^5{c_1}^2+36{c_2}^5{c_1}^3+69{c_2}^5{c_1}^4+75{c_2}^5{c_1}^5+52{c_2}^5{c_1}^6+24{c_2}^5{c_1}^7}{{c_1}^5(1+c_1)^3}$$

$$+\frac{-{c_2}^8{c_3}^2-5{c_1}^7{c_3}^2-3{c_2}^3c_3{c_1}^{10}+12{c_3}^2c_2{c_1}^{10}+18{c_2}^2c_4{c_1}^{10}+2c_4c_3{c_1}^{12}+{c_1}^9{c_2}^5}{{c_1}^5(1+c_1)^3}$$

$$+\frac{-12{c_1}^6{c_2}^2h_4-8{c_1}^7{c_2}^2h_4+{c_3}^2c_2{c_1}^{11}-2{c_1}^8{c_2}^2h_4+2{c_1}^{11}{c_2}^2c_4-8{c_1}^5{c_2}^2h_4-2{c_1}^4{c_2}^2h_4}{{c_1}^5(1+c_1)^3}$$

$$+\frac{{c_1}^3{c_2}^2c_3-2{c_3}^2{c_1}^4+7{c_1}^8{c_2}^5-22{c_1}^9{c_2}^3c_3+18c_4c_3{c_1}^{11}-9{c_1}^6{c_3}^2-7{c_1}^5{c_3}^2}{{c_1}^5(1+c_1)^3})e_n{}^4+O(e_n{}^5).$$

(L.8)

$$a_0=c_1h_4e_n{}^4+c_1h_5e_n{}^5+c_1h_6e_n{}^6+c_1h_7e_n{}^7+(c_2{h_4}^2+c_1h_8)e_n{}^8+O(e_n{}^9).$$

(L.9)

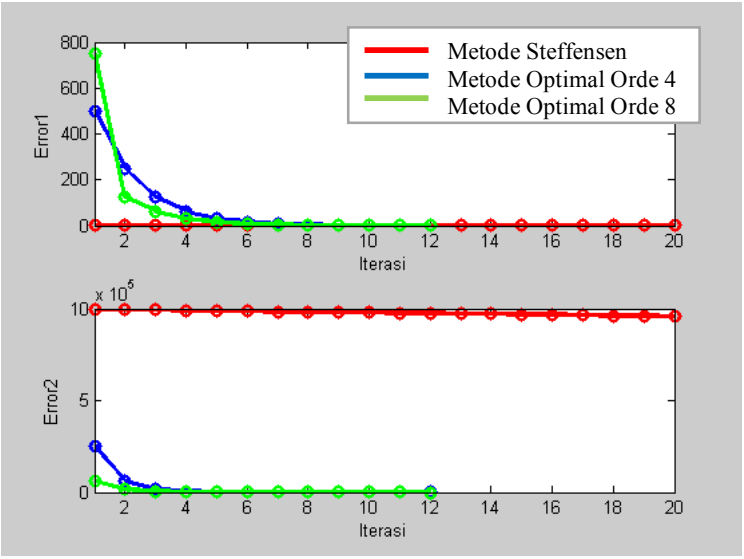
$$a_1=c_1+\frac{{c_1}^3c_2h_4+c_1c_2h_4-{c_3}^2-2{c_3}^2c_1-{c_3}^2{c_1}^2+c_4+2c_1c_4+c_4{c_1}^2+c_1h_4}{c_1}e_n{}^4+O(e_n{}^5).$$

(L.10)

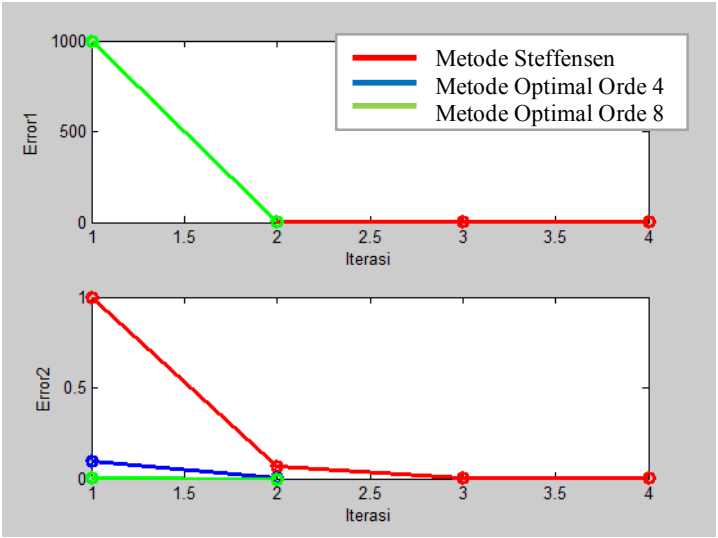
Selanjutnya, hasil a_0 pada persamaan (L.9), hasil b_1 pada persamaan (L.8), dan hasil a_1 pada persamaan (L.10) dilakukan perhitungan $a_1-a_0b_1$ sehingga didapat

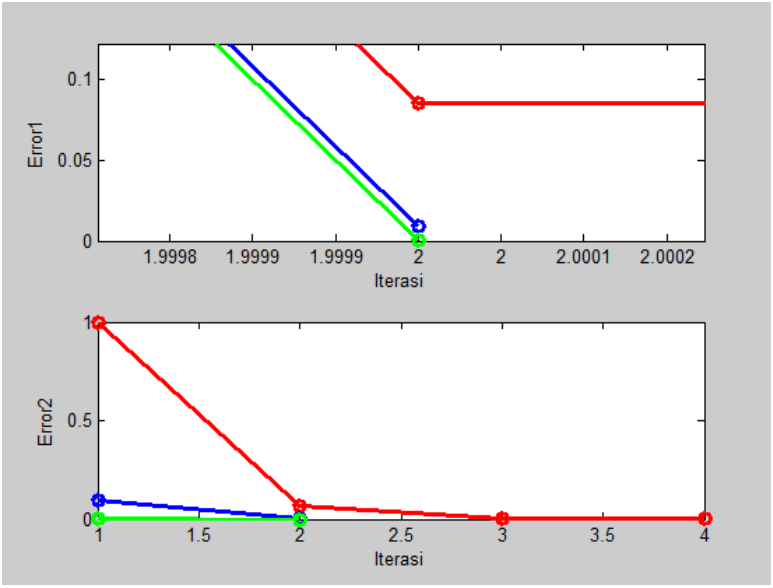
$$a_1-a_0b_1=c_1-\frac{c_1c_2h_4+{c_3}^2+2{c_3}^2c_1+{c_3}^2{c_1}^2-c_4-2c_1c_4-c_4{c_1}^2-c_1h_4}{c_1}e_n{}^4+O(e_n{}^5).$$

Lampiran 4. Grafik Fungsi $f(x)$ Metode Steffensen, Metode Optimal Orde 4, dan Metode Optimal Orde 8

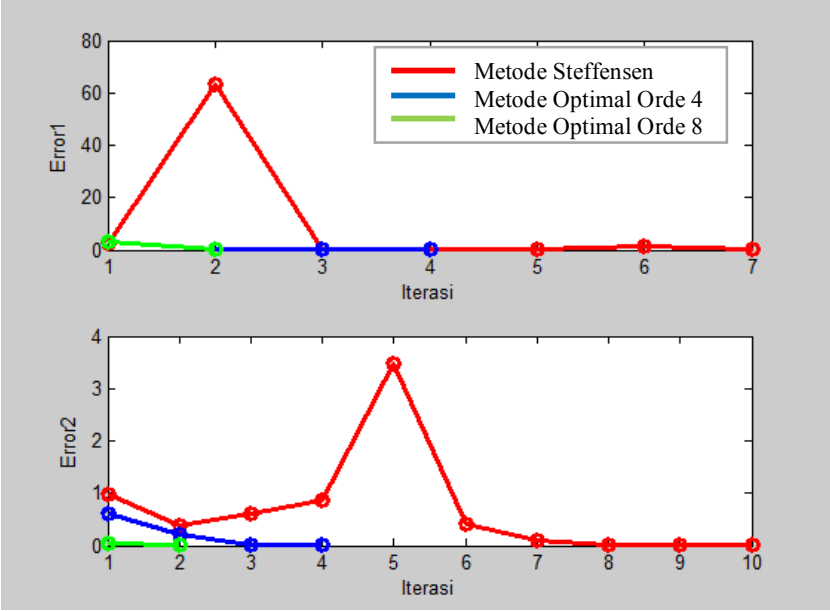


Lampiran 5. Grafik Fungsi $g(x)$ Metode Steffensen, Metode Optimal Orde 4, dan Metode Optimal Orde 8

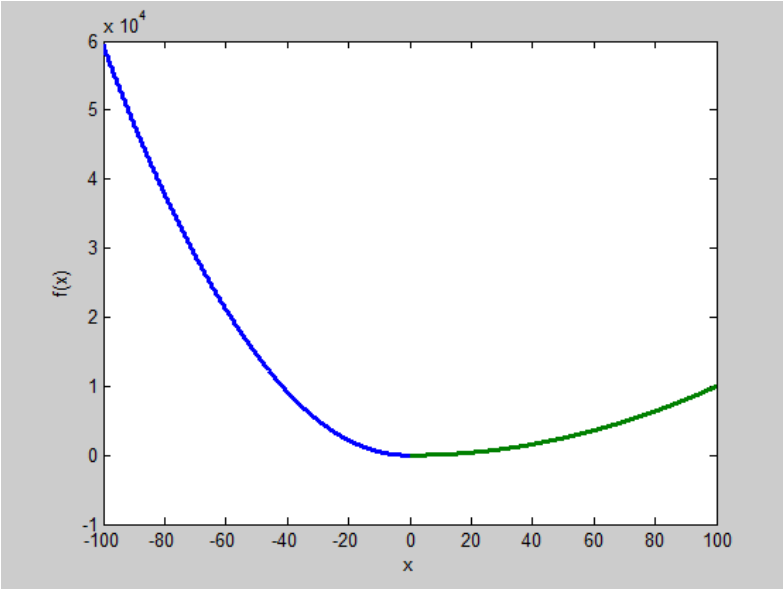




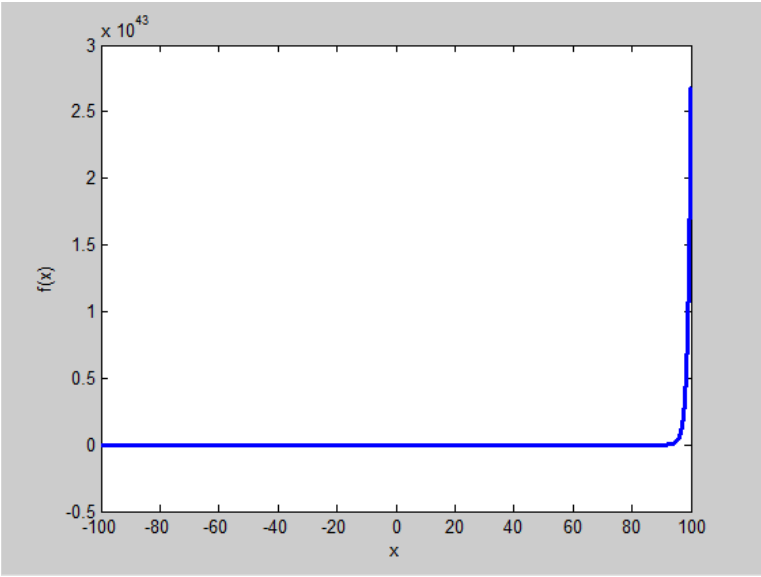
Lampiran 6. Grafik Fungsi $h(x)$ Metode Steffensen, Metode Optimal Orde 4, dan Metode Optimal Orde 8



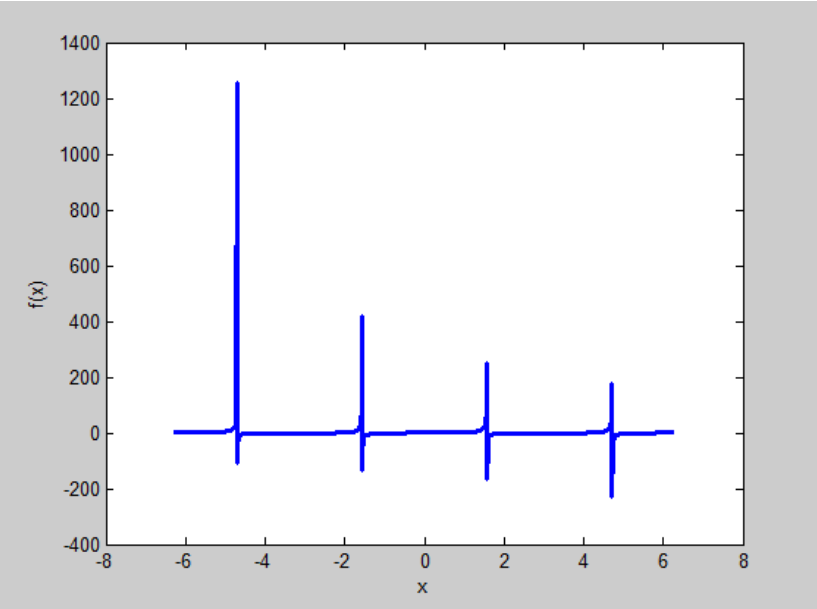
Lampiran 7. Grafik Fungsi $f(x)$



Lampiran 8. Grafik Fungsi $g(x)$



Lampiran 9. Grafik Fungsi $h(x)$



Lampiran 10. Program Matlab Metode Steffensen, Metode Optimal Orde 4, dan Metode Optimal Orde 8 untuk Fungsi $f(x)$

```
clc;
clear all;
tic;
x1(1)=5;
fx1(1)=x1(1)*(x1(1)-1);
i=0;
errore1=10;
errorean1=10;
while errore1>=10^(-8) && errorean1>=10^(-8)
i=i+1;
if x1(i)<0
z1(i)=x1(i)+fx1(i);
fz1(i)=6*z1(i)*(z1(i)+1);
x1(i+1)=x1(i)-(fx1(i)^2)/(fz1(i)-fx1(i));
fx1(i+1)=6*x1(i+1)*(x1(i+1)+1);
else
z1(i)=x1(i)+fx1(i);
```

```
fz1(i)=z1(i)*(z1(i)-1);
x1(i+1)=x1(i)-(fx1(i)^2)/(fz1(i)-fx1(i));
fx1(i+1)=x1(i+1)*(x1(i+1)-1);
end
error1(i)=abs(x1(i+1)-x1(i));
errore1=error1(i);
errorea1(i)=abs(fx1(i+1));
errorean1=errorea1(i);
end
toc;
tic;
x2(1)=5;
fx2(1)=x2(1)*(x2(1)-1);
j=0;
errore2=10;
errorean2=10;
while errore2>=10^(-8) && errorean2>=10^(-8)
j=j+1;
if x2(j)<0
z2(j)=x2(j)+fx2(j);
fz2(j)=6*z2(j)*(z2(j)+1);
y2(j)=x2(j)-(fx2(j)^2)/(fz2(j)-fx2(j));
fy2(j)=6*y2(j)*(y2(j)+1);
fxz2(j)=(fx2(j)-fz2(j))/(x2(j)-z2(j));
fxy2(j)=(fx2(j)-fy2(j))/(x(j)-y2(j));
fyz2(j)=(fy2(n)-fz2(n))/(y2(j)-z2(j));
x2(j+1)=y2(j)-(fy2(j)*fxz2(j))/(fxy2(j)*fyz2(j));
fx2(j+1)=6*x2(j+1)*(x2(j+1)+1);
u(j)=x2(j+1);
fu(j)=6*u(j)*(u(j)+1);
else
z2(j)=x2(j)+fx2(j);
fz2(j)=z2(j)*(z2(j)-1);
y2(j)=x2(j)-(fx2(j)^2)/(fz2(j)-fx2(j));
fy2(j)=y2(j)*(y2(j)-1);
fxz2(j)=(fx2(j)-fz2(j))/(x2(j)-z2(j));
fxy2(j)=(fx2(j)-fy2(j))/(x2(j)-y2(j));
fyz2(j)=(fy2(j)-fz2(j))/(y2(j)-z2(j));
x2(j+1)=y2(j)-(fy2(j)*fxz2(j))/(fxy2(j)*fyz2(j));
fx2(j+1)=x2(j+1)*(x2(j+1)-1);
u(j)=x2(j+1);
fu(j)=u(j)*(u(j)-1);
end
error2(j)=abs(x2(j+1)-x2(j));
```

```
errore2=error2(j);
errorea2(j)=abs(fx2(j+1));
errorean2=errorea2(j);
end
toc;
tic;
x3(1)=5;
fx3(1)=x3(1)*(x3(1)-1);
k=0;
errore3=10;
errorean3=10;
while errore3>=10^(-8) && errorean3>=10^(-8)
k=k+1;
if x3(k)<0
z3(k)=x3(k)+fx3(k);
fz3(k)=6*z3(k)*(z3(k)+1);
y3(k)=x3(k)-(fx3(k)^2)/(fz3(k)-fx3(k));
fy3(k)=6*y3(k)*(y3(k)+1);
fyz3(k)=(fy3(k)-fz3(k))/(y3(k)-z3(k));
fxy3(k)=(fx3(k)-fy3(k))/(x3(k)-y3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fux3(k)=(fu(k)-fx3(k))/(u(k)-x3(k));
fyux3(k)=(fyu3(k)-fux3(k))/(y3(k)-x3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fuz3(k)=(fu(k)-fz3(k))/(u(k)-z3(k));
fyuz3(k)=(fyu3(k)-fuz3(k))/(y3(k)-z3(k));
b1(k)=(fyux3(k)-fyuz3(k))/(fyz3(k)-fxy3(k));
a2(k)=fyux3(k)+b1(k)*fyu3(k);
a1(k)=fyu3(k)-a2(k)*(y3(k)-u(k))+fy3(n)*b1(k);
x3(k+1)=u(k)-((fu(k))/(a1(k)-fu(k)*b1(k)));
fx3(k+1)=6*x3(k+1)*(x3(k+1)+1);
else
z3(k)=x3(k)+fx3(k);
fz3(k)=z3(k)*(z3(k)-1);
y3(k)=x3(k)-(fx3(k)^2)/(fz3(k)-fx3(k));
fy3(k)=y3(k)*(y3(k)-1);
fyz3(k)=(fy3(k)-fz3(k))/(y3(k)-z3(k));
fxy3(k)=(fx3(k)-fy3(k))/(x3(k)-y3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fux3(k)=(fu(k)-fx3(k))/(u(k)-x3(k));
fyux3(k)=(fyu3(k)-fux3(k))/(y3(k)-x3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fuz3(k)=(fu(k)-fz3(k))/(u(k)-z3(k));
fyuz3(k)=(fyu3(k)-fuz3(k))/(y3(k)-z3(k));
```

```
b1(k)=(fyux3(k)-fyuz3(k))/(fyz3(k)-fxy3(k));
a2(k)=fyux3(k)+b1(k)*fyu3(k);
a1(k)=fyu3(k)-a2(k)*(y3(k)-u(k))+fy3(k)*b1(k);
x3(k+1)=u(k)-((fu(k))/(a1(k)-fu(k)*b1(k)));
fx3(k+1)=x3(k+1)*(x3(k+1)-1);
end
error3(k)=abs(x3(k+1)-x3(k));
errore3=error3(k);
errorea3(k)=abs(fx3(k+1));
errorean3=errorea3(k);
end
toc;
figure
subplot(2,1,1)
plot(1:i,error1(1:i),'-or',1:j,error2(1:j),'-
ob',1:k,error3(1:k),'-og','LineWidth',2.5);
xlabel('Iterasi')
ylabel('Error1')
subplot(2,1,2)
plot(1:i,errorea1(1:i),'-or',1:j,errorea2(1:j),'-
ob',1:k,errorea3(1:k),'-og','LineWidth',2.5);
xlabel('Iterasi')
ylabel('Error2')
```

Lampiran 11. Program Matlab Metode Steffensen, Metode Optimal Orde 4, dan Metode Optimal Orde 8 untuk Fungsi $g(x)$

```
clc;
clear all;
tic;
x1(1)=0.1;
fx1(1)=exp(x1(1))+10*x1(1);
i=0;
errore1=10;
errorean1=10;
while errore1>=10^(-8) && errorean1>=10^(-8)
i=i+1;
z1(i)=x1(i)+fx1(i);
fz1(i)=exp(z1(i))+10*z1(i);
x1(i+1)=x1(i)-(fx1(i)^2)/(fz1(i)-fx1(i));
fx1(i+1)=exp(x1(i+1))+10*x1(i+1);
error1(i)=abs(x1(i+1)-x1(i));
errore1=error1(i);
```

```
errorea1(i)=abs(fx1(i+1));
errorean1=errorea1(i);
end
toc;
tic;
x2(1)=0.1;
fx2(1)=exp(x2(1))+10*x2(1);
j=0;
errore2=10;
errorean2=10;
while errore2>=10^(-8) && errorean2>=10^(-8)
j=j+1;
z2(j)=x2(j)+fx2(j);
fz2(j)=exp(z2(j))+10*z2(j);
y2(j)=x2(j)-(fx2(j)^2)/(fz2(j)-fx2(j));
fy2(j)=exp(y2(j))+10*y2(j);
fxz2(j)=(fx2(j)-fz2(j))/(x2(j)-z2(j));
fxy2(j)=(fx2(j)-fy2(j))/(x2(j)-y2(j));
fyz2(j)=(fy2(j)-fz2(j))/(y2(j)-z2(j));
x2(j+1)=y2(j)-(fy2(j)*fxz2(j))/(fxy2(j)*fyz2(j));
fx2(j+1)=exp(x2(j+1))+10*x2(j+1);
error2(j)=abs(x2(j+1)-x2(j));
errore2=error2(j);
errorea2(j)=abs(fx2(j+1));
errorean2=errorea2(j);
end
toc;
tic;
x3(1)=0.1;
fx3(1)=exp(x3(1))+10*x3(1);
k=0;
errore3=10;
errorean3=10;
while errore3>=10^(-8) && errorean3>=10^(-8)
k=k+1;
z3(k)=x3(k)+fx3(k);
fz3(k)=exp(z3(k))+10*z3(k);
y3(k)=x3(k)-(fx3(k)^2)/(fz3(k)-fx3(k));
fy3(k)=exp(y3(k))+10*y3(k);
fxz3(k)=(fx3(k)-fz3(k))/(x3(k)-z3(k));
fxy3(k)=(fx3(k)-fy3(k))/(x3(k)-y3(k));
fyz3(k)=(fy3(k)-fz3(k))/(y3(k)-z3(k));
g(k)=((fy3(k)*fxz3(k))/(fxy3(k)*fyz3(k)));
u(k)=y3(k)-g(k);
```

```
fu(k)=exp(u(k))+10*u(k);
fyz3(k)=(fy3(k)-fz3(k))/(y3(k)-z3(k));
fxy3(k)=(fx3(k)-fy3(k))/(x3(k)-y3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fux3(k)=(fu(k)-fx3(k))/(u(k)-x3(k));
fyux3(k)=(fyu3(k)-fux3(k))/(y3(k)-x3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fuz3(k)=(fu(k)-fz3(k))/(u(k)-z3(k));
fyuz3(k)=(fyu3(k)-fuz3(k))/(y3(k)-z3(k));
b1(k)=(fyux3(k)-fyuz3(k))/(fyz3(k)-fxy3(k));
a2(k)=fyux3(k)+b1(k)*fyu3(k);
a1(k)=fyu3(k)-a2(k)*(y3(k)-u(k))+fy3(k)*b1(k);
x3(k+1)=u(k)-((fu(k))/(a1(k)-fu(k)*b1(k)));
fx3(k+1)=exp(x3(k+1))+10*x3(k+1);
error3(k)=abs(x3(k+1)-x3(k));
errore3=error3(k);
errorea3(k)=abs(fx3(k+1));
errorean3=errorea3(k);
end
toc;
figure
subplot(2,1,1)
plot(1:i,error1(1:i),'-or',1:j,error2(1:j),'-
ob',1:k,error3(1:k),'-og','LineWidth',2.5);
xlabel('Iterasi')
ylabel('Error1')
subplot(2,1,2)
plot(1:i,errorea1(1:i),'-or',1:j,errorea2(1:j),'-
ob',1:k,errorea3(1:k),'-og','LineWidth',2.5);
xlabel('Iterasi')
ylabel('Error2')
```

Lampiran 12. Program Matlab Metode Steffensen, Metode Optimal Orde 4, dan Metode Optimal Orde 8 untuk Fungsi $h(x)$

```
clc;
clear all;
tic;
x1(1)=0;
fx1(1)=sin(x1(1))+cos(x1(1))+tan(x1(1));
i=0;
errore1=10;
errorean1=10;
```

```
while errore1>=10^(-8) && errorean1>=10^(-8)
i=i+1;
z1(i)=x1(i)+fx1(i);
fz1(i)=sin(z1(i))+cos(z1(i))+tan(z1(i));
x1(i+1)=x1(i)-(fx1(i)^2)/(fz1(i)-fx1(i));
fx1(i+1)=sin(x1(i+1))+cos(x1(i+1))+tan(x1(i+1));
error1(i)=abs(x1(i+1)-x1(i));
errore1=error1(i);
errorea1(i)=abs(fx1(i+1));
errorean1=errorea1(i);
end
toc;
tic;
x2(1)=0;
fx2(1)=sin(x2(1))+cos(x2(1))+tan(x2(1));
j=0;
errore2=10;
errorean2=10;
while errore2>=10^(-8) && errorean2>=10^(-8)
j=j+1;
z2(j)=x2(j)+fx2(j);
fz2(j)=sin(z2(j))+cos(z2(j))+tan(z2(j));
y2(j)=x2(j)-(fx2(j)^2)/(fz2(j)-fx2(j));
fy2(j)=sin(y2(j))+cos(y2(j))+tan(y2(j));
fxz2(j)=(fx2(j)-fz2(j))/(x2(j)-z2(j));
fxy2(j)=(fx2(j)-fy2(j))/(x2(j)-y2(j));
fyz2(j)=(fy2(j)-fz2(j))/(y2(j)-z2(j));
x2(j+1)=y2(j)-(fy2(j)*fxz2(j))/(fxy2(j)*fyz2(j));
fx2(j+1)=sin(x2(j+1))+cos(x2(j+1))+tan(x2(j+1));
error2(j)=abs(x2(j+1)-x2(j));
errore2=error2(j);
errorea2(j)=abs(fx2(j+1));
errorean2=errorea2(j);
end
toc;
tic;
x3(1)=0;
fx3(1)=sin(x3(1))+cos(x3(1))+tan(x3(1));
k=0;
errore3=10;
errorean3=10;
while errore3>=10^(-8) && errorean3>=10^(-8)
k=k+1;
z3(k)=x3(k)+fx3(k);
```

```
fz3(k)=sin(z3(k))+cos(z3(k))+tan(z3(k));
y3(k)=x3(k)-(((fx3(k))^2)/(fz3(k)-fx3(k)));
fy3(k)=sin(y3(k))+cos(y3(k))+tan(y3(k));
fxz3(k)=(fx3(k)-fz3(k))/(x3(k)-z3(k));
fxy3(k)=(fx3(k)-fy3(k))/(x3(k)-y3(k));
fyz3(k)=(fy3(k)-fz3(k))/(y3(k)-z3(k));
g(k)=((fy3(k)*fxz3(k))/(fxy3(k)*fyz3(k)));
u(k)=y3(k)-g(k);
fu(k)=sin(u(k))+cos(u(k))+tan(u(k));
fyz3(k)=(fy3(k)-fz3(k))/(y3(k)-z3(k));
fxy3(k)=(fx3(k)-fy3(k))/(x3(k)-y3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fux3(k)=(fu(k)-fx3(k))/(u(k)-x3(k));
fyux3(k)=(fyu3(k)-fux3(k))/(y3(k)-x3(k));
fyu3(k)=(fy3(k)-fu(k))/(y3(k)-u(k));
fuz3(k)=(fu(k)-fz3(k))/(u(k)-z3(k));
fyuz3(k)=(fyu3(k)-fuz3(k))/(y3(k)-z3(k));
b1(k)=(fyux3(k)-fyuz3(k))/(fyz3(k)-fxy3(k));
a2(k)=fyuz3(k)+b1(k)*fyz3(k);
a1(k)=fyu3(k)-a2(k)*(y3(k)-u(k))+fy3(k)*b1(k);
x3(k+1)=u(k)-((fu(k))/(a1(k)-fu(k)*b1(k)));
fx3(k+1)=sin(x3(k+1))+cos(x3(k+1))+tan(x3(k+1));
error3(k)=abs(x3(k+1)-x3(k));
errore3=error3(k);
errorea3(k)=abs(fx3(k+1));
errorean3=errorea3(k);
end
toc;
figure
subplot(2,1,1)
plot(1:i,error1(1:i),'-or',1:j,error2(1:j),'-
ob',1:k,error3(1:k),'-og','LineWidth',2.5);
xlabel('Iterasi')
ylabel('Error1')
subplot(2,1,2)
plot(1:i,errorea1(1:i),'-or',1:j,errorea2(1:j),'-
ob',1:k,errorea3(1:k),'-og','LineWidth',2.5);
xlabel('Iterasi')
ylabel('Error2')
```